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A REPORT
on
Grodek Dam

Prepared by
Project Treasure Island
for
Directorate of Intelligence, USAF
1954

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A R E P O R T

on

G R O D E K D A M (P O L A N D)

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REPORT

on

Grodek Dam in Poland

This report contains information requested on the Grodek Dam on the Czarna Woda (Wda) River in Poland.

The information submitted is the result of a study of Polish and Czech open sources, published between 1921 and 1938 and listed in the attached bibliography. The most valuable material was found in the sources listed under No. 3.

The report was compiled in accordance with the P.V.D. questionnaire as follows:

I. FunctionsA. The system of which the dam forms a part

With respect to power production the Grodek Dam with its powerhouse forms a part of an interconnected power system supplying energy to the Wojewodztwo Bydgoskie (province of Bydgoszcz), known as the "Pomorska Elektrownia Krajowa "Grodek" , S. A. w Toruniu," (Regional Pomeranian Electric Power Plant "Grodek" Inc. in Torun). The development of this system as it existed in 1936 and as it was planned for the future, is shown on map, Fig. 1.

B. The dam within the system

The only purpose of the dam is power production. The Grodek Power Plant serves as a base-load plant. It is preceded by the Zur Dam with a peak-load power plant located 7 km upstream from Grodek.

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G. Highways and railways resting on the dam or adjacent thereto

No highway or railroad rests on the dam.

D. Navigation locks on the dam or adjacent thereto

No navigation locks were built. There exists, however, a log chute used for occasional floating of timber.

II. Location and designationA. Data which will make possible pinpointing the installation

The Grodek Dam is located on the Czarna Woda (Wda) River, a left bank tributary of the Wisla (Vistula) River. The Grodek Development is in the province of Bydgoszcz, county Swiecie. The dam is 30 km upstream from the town of Swiecie, located at the confluence of the Vistula and Wda rivers (Fig. 1).

B. Official, local, and popular names of dams and dependent installations

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Pomorska Elektrownia Krajowa "Groddek," S. A. w Toruniu.

III. DimensionsA. Dam1. Maximum and minimum head on dam

Head on dam: about 11 m;

Head on powerhouse: 18 m.

2. Maximum and minimum depth of water below dam

It is a diversion dam with a small flood discharge into the downstream riverbed.

3. Total height of dam above river bed and above foundations

Height of dam above river bed is 18 m (Fig. 2).

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4. Elevation of bottom of penstocks at dam

There are no penstocks in the dam.

5. Total thickness at base and at high water level

Width of dam at crown is 6 m (Fig. 2).

6. Slopes of dam faces

The upstream face slope 1:2 to 1:3 (Fig. 2).

The downstream face slope 1:3 to 1:5 (Fig. 2).

7. Length at crown, across river bed and along spillway

No information available.

B. Reservoir1. Capacity of the Grodek Reservoir

6,000,000 cu m.

2. Area

100 ha.

3. Length, width and depth (including profiles)

See Figs. 2, 3 and 4.

4. Detailed plan in vicinity of dam

A bird's-eye view of the powerhouse, diversion canal, reservoir and dam is presented in Figs. 2 and 3.

C. Navigation locks in connection with dams

No navigation locks were built in this dam.

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IV. Hydrological data (rainfall, flow, etc.)General data on the region (Pomerania)

The average annual rainfall in Pomerania is 550 mm. The average runoff per sq km for Pomeranian rivers is between 3.1 and 8.2 liters/sec. The average incline of Pomeranian rivers is 0.5 to 1.5 o/oo.

The lakes of Pomerania form natural reservoirs and contribute to the regularity of the flow.

Data on Czarna Woda (Wda) River

The average annual rainfall for the catchment area of the Czarna Woda River is 549 mm.

The average runoff per sq km is 8.6 liters/sec. Maximum runoff is 21.9 liters/sec. The minimum is 3 liters/sec.

The catchment area of the whole Wda River is 2,202 sq km. The catchment area upstream from the Grodek Dam is 1,850 sq km.

The total length of the Czarna Woda River is about 185 km. It rises 49 km from Lake Wdzydze which lies at an elevation of 133 m.

The Grodek Dam is located at an elevation of 34 m.

The average flow of the Czarna Woda River at the Grodek Dam is 8 cu m/sec. The width of the river below the power plant is 20 m.

V. Foundation conditions and soil characteristics under and near the dam

The subsoil at the dam consists of alluvial layers intermixed with fine, sometimes loamy but mostly clean sand, and of a layer of dark sand with thick pieces of clay, which on the left side of the dam takes the shape of thick layers of clay. Marsh surface lies at an

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elevation of about 42 m. All the unsuitable soils were removed and the foundations of the dam are based on clay or on strong layers of sand.

VI. Design data

A. Structural type or types

The dam is an embankment earth (clay) dam with a discharge sluice.

B. Materials used (Fig. 2).

The dam is built of clay and sand obtained from digging the diversion canal. The upstream toe of the dam is made of broken stones. 20-cm thick layers of clear gray clay, stamped by hand, are placed on the upstream slope. The clay layers are covered by gravel and faced with 100 by 60-cm concrete slabs, 15 cm thick. The dam's core consists of stamped clay, the remaining is a fill-up of clay and sand. The dam has two rows of cut-off curtains which reach deep into the loamy sand and clay layers. The cut-off curtains are made of wood piling, with the exception of the central river bed section of the first upstream row. This section consists of Larssen steel-sheet piling.

C. Design criteria

No information available.

D. Details and equipment (penstocks, control gates, inspection galleries, cranes, etc.)

1. Spillway

The spillway is built in the central part of the dam and is supported by Larssen sheet-piling. A discharge sluice is

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built under the spillway near the bottom. No information available as to dimensions and other data.

2. Diversion canal (Figs. 3 and 4)

The canal is 1.4-km long and cuts across the sharp river bend. The natural difference in levels along this bend is 7 m which, added to the 11 m of the rise at the dam, gives a head of 18 m. The canal has a incline of 1:5000 and a trapezoidal cross-section. Its maximum depth is 20 m. The entrance to the canal can be closed by emergency stop-logs, operated by hand.

The mean flow in the canal is 12 cu m/sec.

3. Log chute

A log chute connects the lower part of the diversion canal with the tailwater near the powerhouse. The log chute is of the ladder type.

4. Penstocks, cranes

There are neither penstocks, nor cranes at the dam.

VII. Special data on power dams

A. Capacity (kva) present and proposed

10,000 kva - 7,500 kw (1938).

B. Output (kwh/yr) achieved and proposed

Some data on the output achieved:

1927 - 9,866,000 kwhr

1928 - 12,434,900 kwhr

1929 - 11,961,000 kwhr

1937 - 9,979,000 kwhr (latest pre-war data available).

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The output proposed for Grodek in 1923 was 10,000,000 kwhr.

It was expected to rise to 13,000,000 kwhr after the construction of the second dam, 7 km upstream (Zur).

C. Powerhouse (see Figs. 3 and 5)

1. Location

At the end of the diversion canal, 1.4 km from the reservoir.

2. Structure

The powerhouse is a five-story structure (Fig. 5) of reinforced concrete erected on a foundation of a tight Larssen steel-sheet cut-off wall filled with reinforced concrete.

3. Installations (Turbogenerators, etc.)

The powerhouse is equipped with three turbines. The first two, installed in 1923, are twin, horizontal, 1,700-hp, 300-rpm Francis turbines, coupled directly with two horizontal three-phase 1,720-kva, 300-rpm, 3,000-v generators.

A third generating unit was installed in 1927.

The 3/15-kv transformers with the switchgear are located in the basement of the powerhouse. The control room is located above the generator room.

There is a 20-ton traveling crane located in the powerhouse above the turbines.

4. Number, dimensions, location and type of penstocks

No data are available.

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D. Places or installations served: ties with power grids

The Grodek and Zur Hydroelectric Power Plants and the steam electric power plants in Grudziadz and Gdynia, belong to the same network. The 60-kv Grodek-Zur-Gdynia transmission line is the main transmission line for this system. The network supplies electric power to Gdynia for industries and public utilities and to several towns in Pomerania, chiefly for public utility consumption (Fig. 1).

E. Location and description of transformer yards and transmission system

No data are available on the 60-kv transformer yards in Grodek. A 60-kv transmission line, 138 km long, leads from Grodek, through Zur to Gdynia. The average height of wood poles used for the line is between 16 and 18 m. Steel towers, 30 m high, were erected in the town of Gdynia. There is a 60/6-kv stepdown transformer substation in Gdynia.

VIII. Historical data

A. Name and background of the designer

Work on the Grodek Dam was started before the First World War by the Provinzialverband Westpreussen (Germany). After the war it was taken over by the Polish Pomorski Krajowy Związek Komunalny (Communal Union of Pomerania Region) which placed it under a corporation organized in 1924, named "Pomorska Elektrownia Krajowa 'Grodek' Spółka Akcyjna w Toruniu" - (Regional Pomeranian Electric Power Plant "Grodek" Inc., in Torun").

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B. Dates of construction

Work on the dam was started in 1914 by German Regional authorities, the Provinzialverband Westpreussen, but they did not progress beyond laying concrete foundations for the powerhouse.

During the war, from 1914 to 1920, work was almost completely stopped, and it was resumed in 1920 by local Polish authorities (See Chapter VIII-A).

All construction work on the dam and the powerhouse was completed in 1922. Early in 1923 two generating units, a 3/15-kv transformer and switchgear equipment were installed. The power plant was put into operation on April 24, 1923. A third unit was installed and put into operation on August 6, 1927. The construction of the 60-kv, 138-km transmission line from Grodek to Gdynia, was completed in 1928.

C. Sources of material

Earth (clay) excavated from the diversion canal was used for the dam. Cement, iron, Larsen cut-off piling, stone and sand were obtained from local sources.

The Francis turbines came from J. M. Voith, St. Poelten, Austria.

The generators came from Siemens-Schuckert, Germany.

All equipment for the 3/15-kv transformers, switchgear, control room and busbar came from Brown-Boveri in Baden, Switzerland.

The crane in the powerhouse came from Rudzki K. & Co., Warsaw, Poland.

D. Records of war damage, failures, removal of equipment, etc.

No information available.

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E. Data on conditions of structure at any date

The last known year of operation is 1938.

F. Proposals for enlargement, alteration or extension of function

No further expansion of the powerhouse is planned since the entire power resources of the river were already utilized by the Grodek and Zur Power Plants.

IX. Graphic material

A. Photographs

Photographs attached to this report are shown in Figs. 3, 4, and 5.

B. Working drawings, general and detailed

None available.

C. Record and publication drawings

Figs. 1 and 2.

D. Sketches by persons who have seen installations

None available.

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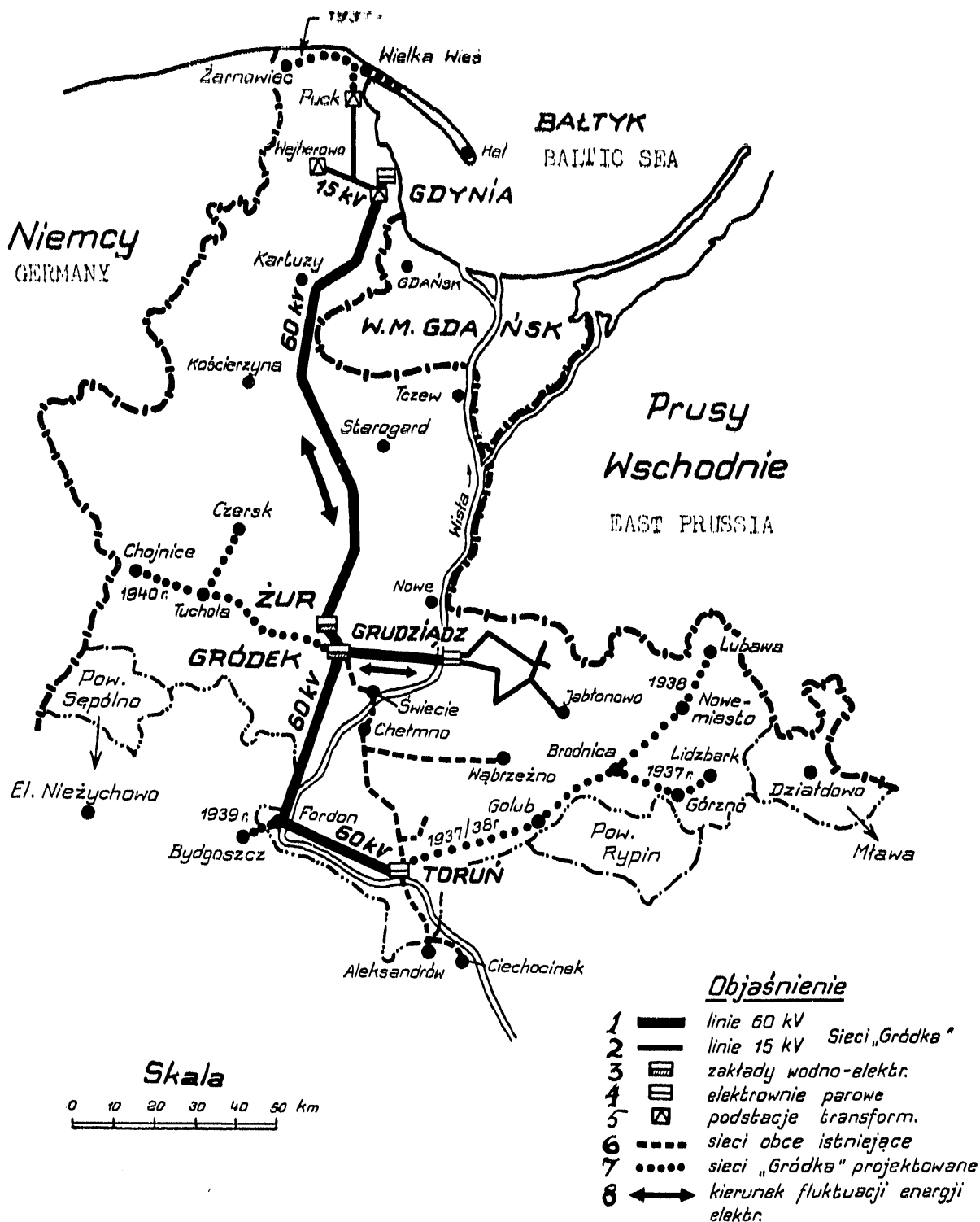
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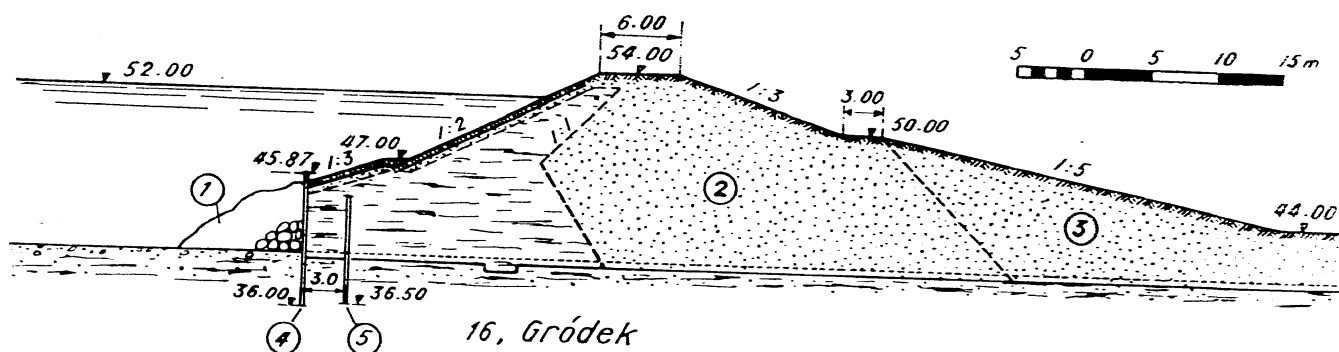
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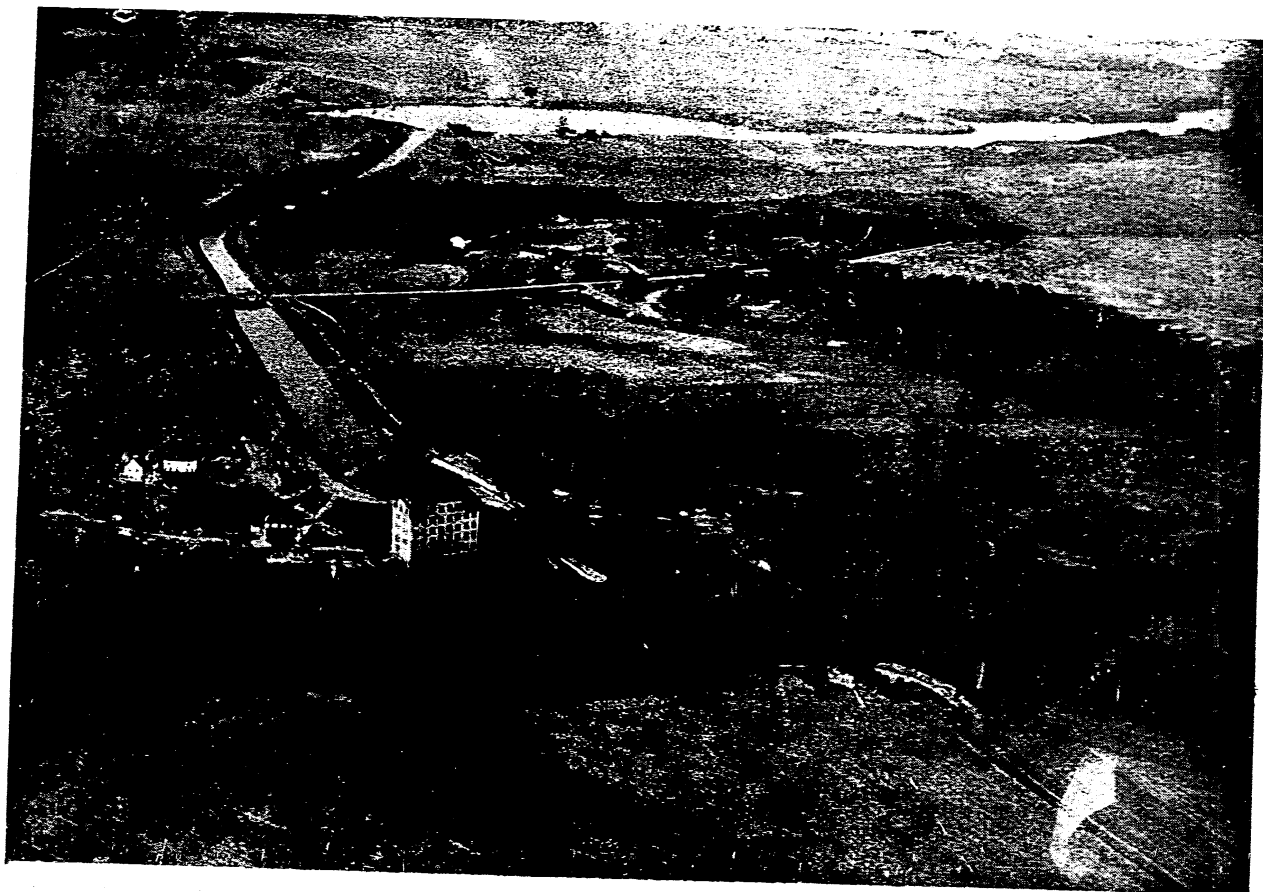


ZUR DAM, Poland. Transmission Network of the "Gródek System". 1) 60-kv Gródek transmission lines 2) 15-kv Gródek transmission lines 3) Hydro power plants 4) Steam power plants 5) Transformer substations 6) Other adjoining transmission lines 7) Proposed extension of Gródek network 8) Interchange of electric power.

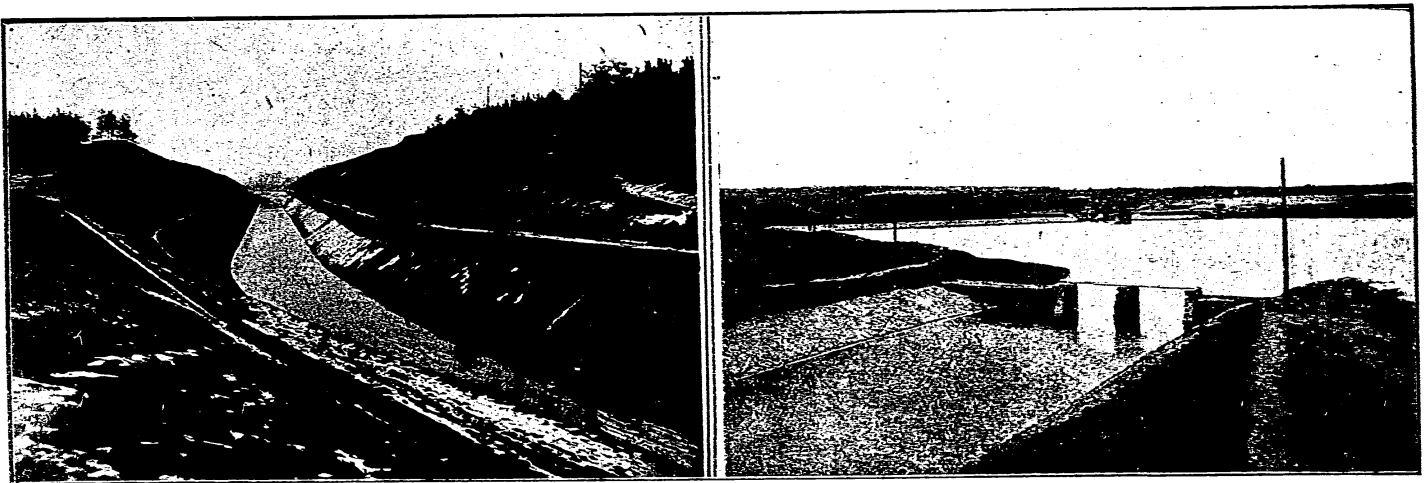
Source: Przegląd Elektrotechniczny, Warsaw, 1936, No. 23, Dec.1, p.788



GRODEK DAM, POLAND. Cross-Section of the Dam. Source: Second Congress on Large Dams, Washington, D.C., 1936, Transactions, Vol. IV, p. 408. 1) underwater fill 2) rammed sand 3) filled 4) steel sheet-piling 5) wooden sheet-piling.

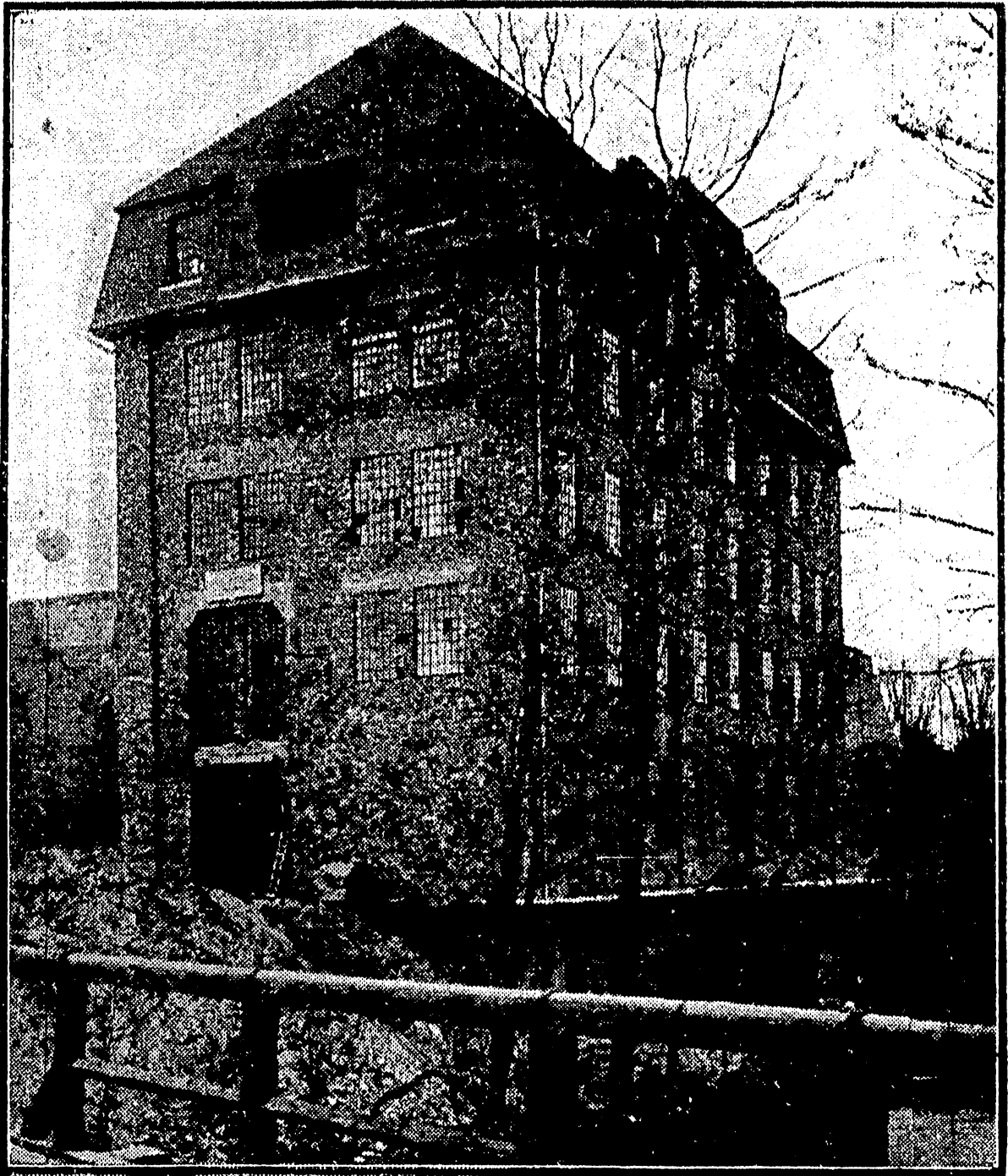


GRODEK DAM, Poland. Powerhouse, Diversion Canal, and Reservoir.
Source: Przegląd Elektrotechniczny, Warsaw, 1930, p. 75



Diversion Canal
GRODEK DAM, Poland. Source: Przegląd Elektrotechniczny, Warsaw, 1923, July 15, No. 14, p. 247

Reservoir, Dam, and Diversion Canal



GRODEK DAM, Poland .Powerhouse .
Source :Przegląd Elektrotech-
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